CHAPTER 1.

# Global trends in overweight and obesity

*Chizuru Nishida, Elaine Borghi, Francesco Branca, and Mercedes de Onis*

Obesity is now well recognized as a disease in its own right, one that is largely preventable through changes in lifestyle, especially diet. Obesity is also a major risk factor associated with increased morbidity and mortality from many noncommunicable diseases (NCDs).

Obesity in adulthood increases the likelihood of type 2 diabetes mellitus, hypertension, coronary heart disease, stroke, certain cancers, obstructive sleep apnoea, and osteoarthritis. It also negatively affects reproductive performance [1].

Overweight and obesity in childhood are associated with a higher probability of obesity in adulthood and may have devastating consequences for this very vulnerable age group. Children who are overweight or obese are at a higher risk of developing serious health problems, including type 2 diabetes, high blood pressure, asthma and other respiratory problems, sleep disorders, and liver disease. They may also suffer from psychological effects, such as low self-esteem, depression, and social isolation [2].

In 1997, the World Health Organization (WHO), recognizing the rapidly increasing prevalence of obesity and its overwhelming social, economic, and public health consequences, held, for the first time, an Expert Consultation on Obesity [3]. The Expert Consultation reviewed the global prevalence of obesity and trends in obesity in children and adults, factors contributing to the problem of obesity, and associated consequences of obesity. It also examined the health and economic consequences of obesity and their impact on development, and developed recommendations to assist countries in developing comprehensive public health policies and strategies for improving the prevention and management of obesity. Since then, WHO has organized several technical meetings to address various issues related to the prevention and control of obesity.

In 2012, 15 years after the first Expert Consultation on Obesity was held, the Sixty-fifth World Health Assembly endorsed the Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition [4] together with the six global nutrition targets to be attained by 2025 [5]. One of the six global nutrition targets is to “ensure that there is no increase in childhood overweight”. To accelerate the efforts of WHO and to develop a comprehensive response to childhood obesity, the WHO Director-General established a high-level Commission on Ending Childhood Obesity (ECHO) in May 2014.

In 2013, the Sixty-sixth World Health Assembly endorsed the Global

Action Plan for the Prevention and Control of NCDs 2013–2020, including a set of nine voluntary global targets to be attained by 2025 and a global monitoring framework. One of the nine targets is to "halt the rise in diabetes and obesity", and one important indicator related to this target is obesity in adolescents. However, identifying obesity during adolescence is difficult, because of continual changes in body composition, differences in the age of onset of puberty, and differential rates of fat accumulation. Prompted by the increasing need to develop an appropriate single growth reference for screening and monitoring of school-aged children and adolescents, in 2007 WHO developed a growth reference for these population groups (aged 5–19 years), which is aligned with the WHO Child Growth Standards at age 5 years and with the recommended adult cut-off points for overweight and obesity at age 19 years [6]. In school-aged children and adolescents, the 2007 WHO classification system defines overweight as body mass index (BMI)-for-age > +1 standard deviation (SD) from the WHO growth reference median (equivalent to a BMI of 25 kg/m$^2$ at 19 years) and obesity as BMI-for-age > +2 SD from the median (equivalent to a BMI of 30 kg/m$^2$ at 19 years) [6].

Unfortunately, WHO has not yet been compiling the data for this age group systematically and comprehensively, except in the WHO European Region. The WHO European Childhood Obesity Surveillance Initiative (COSI) was established in 2007 by the action network on childhood obesity surveillance to provide regular and comparable data on overweight and obesity in primary schoolchildren. Selected schools in participating countries gather data according to an agreed protocol containing core items and consisting of national representative samples. At the global level, efforts are currently being made to fill this data gap, in particular for those aged 10–18 years, and to generate estimates for prevalence of overweight and obesity in adolescents, using data available in 2016.

Therefore, this chapter focuses on obesity only in children younger than 5 years and in adults.

## Defining overweight and obesity in children younger than 5 years

In 1993, WHO undertook a comprehensive review of the uses and interpretation of anthropometric references. The review concluded that the United States National Center for Health Statistics (NCHS)/WHO child growth reference, which had been recommended for international use since the late 1970s, did not adequately represent early childhood growth and that new growth curves were necessary. In 1994, the Forty-seventh World Health Assembly endorsed this recommendation. In response, WHO undertook the Multicentre Growth Reference Study (MGRS) between 1997 and 2003 to generate new curves for assessing the growth and development of children worldwide.

The MGRS included 1737 breastfed infants and young children (894 boys and 843 girls), who were from six geographically distinct sites (Brazil, Ghana, India, Norway, Oman, and the USA) and were raised in environments that did not constrain growth. Rigorous methods of data collection and standardized procedures across study sites yielded data of very high quality. These data were used to develop the WHO Child Growth Standards [7], which were released in 2006, replacing the previously recommended 1977 NCHS/WHO child growth reference.

Based on the WHO Child Growth Standards, in children younger than 5 years, overweight is defined as weight-for-height > +2 SD from the WHO Child Growth Standards median, and obesity as weight-for-height > +3 SD from the median. "At risk of overweight" is defined as weight-for-height > +1 SD and ≤ +2 SD from the median.

## Trends in overweight and obesity in children younger than 5 years

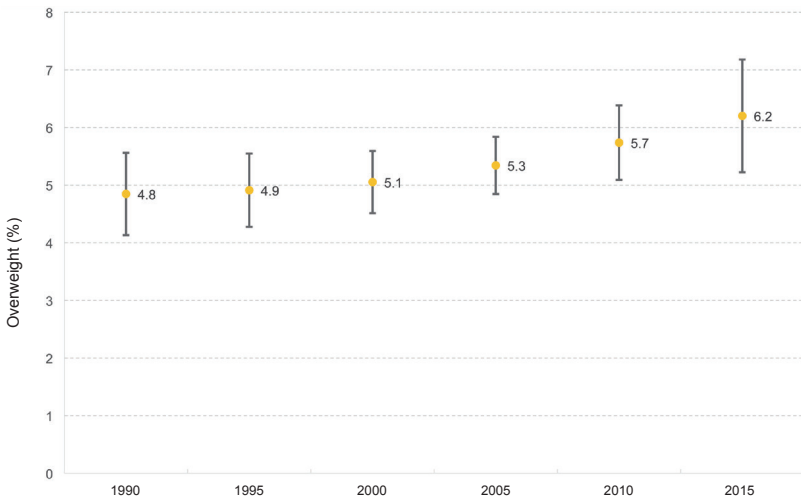
In September 2015, the United Nations Children's Fund (UNICEF), WHO, and the World Bank Group released updated joint child malnutrition estimates based on 778 national surveys, from 150 countries and territories, representing more than 90% of all children younger than 5 years globally. The prevalence of overweight in children younger than 5 years has been increasing steadily, from 4.8% in 1990 to 6.2% in 2015 (Fig. 1.1), despite overlapping 95% confidence intervals across the years [8]. In 2014 there were 41 million overweight children younger than 5 years in the world, about 10 million more than there were in 1990.

In 2014, almost half of all overweight children younger than 5 years lived in Asia, and one quarter lived in Africa. The number of overweight children younger than 5 years in Africa has nearly doubled since 1990. The number of overweight children in lower-middle-income countries has more than doubled since 1990, from 7.5 million to 15.5 million [8].

## Classifying overweight and obesity in adults

BMI is calculated as the weight in kilograms divided by the square of the height in metres (kg/m$^2$). It is commonly used to classify overweight and obesity in adults. BMI values are age-independent and the same for both sexes. However, BMI

**Fig. 1.1.** Trend in the prevalence of overweight in children younger than 5 years (and 95% confidence intervals), according to the latest child malnutrition estimates from UNICEF, WHO, and World Bank Group (2015) [8].




may not correspond to the same degree of fatness in different populations, due, in part, to differences in body proportions.

Because BMI does not measure fat mass or fat percentage and because there are no clearly established cut-off points for fat mass or fat percentage that can be translated into cut-offs for BMI, the WHO Expert Committee on Physical Status: the Use and Interpretation of Anthropometry [9], which met in 1993, decided to express different levels of high BMI in terms of degrees of overweight rather than degrees of obesity, which would imply knowledge of body composition.

For adults, the 1993 Expert Committee [9] proposed a BMI classification with cut-off points of 25, 30, and 40 kg/m$^2$ for the three degrees of overweight as shown in Table 1.1.

This classification is based primarily on the association between BMI and mortality, and the following considerations are important in interpreting these cut-off points [9].

- The recommended cut-offs are appropriate for identifying the extent of overweight in individuals and populations, but they do not imply targets for intervention.
- The broad ranges of BMI do not imply that the individual can fluctuate within this range without consequence; for example, for an individual of height 1.75 m, the BMI range of 18.5–25 kg/m$^2$ covers a weight range of 20 kg. Weight gain in adult life may be associated with increased morbidity and mortality independently of the original degree of overweight.
- The cut-off points for degrees of overweight should not be interpreted in isolation but should always be interpreted in combination with other determinants of morbidity and mortality (disease, smoking, blood pressure, serum lipids, glucose intolerance, type of fat distribution, etc.).

The 1997 WHO Expert Consultation on Obesity [3] reiterated the BMI classification of overweight and obesity as shown in Table 1.2.

The classification shown in Table 1.2 is in agreement with the one recommended by the 1993 Expert Committee (Table 1.1), except that obesity is classified as a BMI ≥ 30 kg/m$^2$ and it also includes an additional subdivision at a BMI of 35.0–39.9 kg/m$^2$ in recognition of the fact that management options for dealing with obesity differ above a BMI of 35 kg/m$^2$.

Table 1.2 shows a simplistic relationship between BMI and the risk of comorbidity, which can be affected by a range of factors, including the nature of the diet, ethnicity, and activity level. The method used to establish BMI cut-off points has been largely arbitrary. Therefore, it was considered that perhaps population-specific BMI cut-off points may be required to more accurately identify overweight and obesity in different population groups, in particular in Asian populations.

To address this debate, WHO held an Expert Consultation in 2002 to review and assess the issues related to whether population-specific BMI cut-off points are needed in Asian populations [10]. The Expert Consultation reviewed the scientific

**Table 1.1.** Classification of BMI proposed by the 1993 WHO Expert Committee on Physical Status

| Classification | BMI (kg/m$^2$) |
|---|---|
| Normal range | 18.50–24.99 |
| Grade 1 overweight | 25.00–29.99 |
| Grade 2 overweight | 30.00–39.99 |
| Grade 3 overweight | ≥ 40.00 |

BMI, body mass index.

*Source:* Compiled from WHO (1995) [9].

**Table 1.2.** Classification of BMI proposed by the 1997 WHO Expert Consultation on Obesity

| Classification | BMI (kg/m²) | Risk of comorbidities |
|---|---|---|
| Underweight | < 18.50 | Low (but risk of other clinical problems increased) |
| Normal range | 18.50–24.99 | Average |
| Overweight | ≥ 25.00 | |
| Pre-obese | 25.00–29.99 | Increased |
| Obese class I | 30.00–34.99 | Moderate |
| Obese class II | 35.00–39.99 | Severe |
| Obese class III | ≥ 40.00 | Very severe |

BMI, body mass index.

*Source:* Reprinted with permission from WHO (2000) [3].

evidence on the relationships between BMI, percentage of body fat, and health risks in Asian populations, which has suggested differences in these relationships compared with those observed in European populations. The Expert Consultation concluded that the proportion of Asian people who are at a risk of developing type 2 diabetes and cardiovascular disease is substantial at BMI levels below the existing WHO BMI cut-off point for overweight (25 kg/m²). However, the currently available data do not necessarily indicate *one* clear BMI cut-off point for all Asians for overweight or obesity. The BMI cut-off point for observed risk in different Asian populations varies from 22 kg/m² to 25 kg/m²; for high risk, it varies from 26 kg/m² to 31 kg/m². Therefore, no attempt was made to redefine BMI cut-off points for each population separately. Rather, the Expert Consultation identified potential public health action points along the continuum of BMI (23.0, 27.5, 32.5, and 37.5 kg/m²) and proposed methods by which countries could make decisions about the definitions of increased risk for their populations. It was further agreed that the current WHO BMI cut-off points should be retained as international classifications.

Furthermore, the 1997 WHO Expert Consultation also recommended that waist circumference (WC) be used in addition to BMI as indicative of abdominal fatness associated with an increased risk of metabolic and other complications associated with obesity [3]. However, the Expert Consultation concluded that globally applicable cut-off points for WC or waist–hip ratio (WHR), which is another possible indicator of abdominal fatness, could not be developed at that stage due to the fact that populations differ in the risks associated with a particular WC or WHR. In 2008, WHO organized an Expert Consultation to review the scientific evidence and draw up clear recommendations on the issues related to WC and WHR in adults [11]. Given the limited data available, the Expert Consultation did not recommend actual cut-off points for WC or WHR but provided guidance and steps to be taken to arrive at appropriate WHO recommendations in this critical area.

## Trends in obesity in adults

The prevalence of obesity in adults has been increasing in all countries. In 2014, 39% of adults aged 18 years and older (38% of men and 40% of women) were overweight. The worldwide prevalence of obesity nearly doubled between 1980 and 2014 [1] (Fig. 1.2).

In all WHO regions, women are more likely to be obese than men [1] (Fig. 1.3). The prevalence of overweight and obesity generally increases with the income level of countries. The prevalence of obesity in high-income and upper-middle-income countries is more than double that in low-income countries [1] (Fig. 1.4).

**Fig. 1.2.** Trend in the prevalence of obesity in adults. Red dashed line: data from Stevens et al. (2012) [12]. Blue diamond: latest obesity estimate for adults, from WHO (2014) [1]. The corresponding 95% confidence intervals are shown.

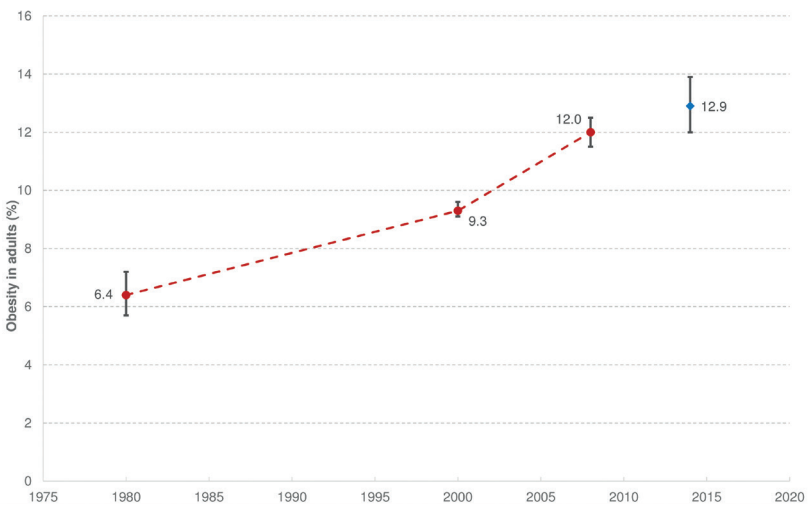
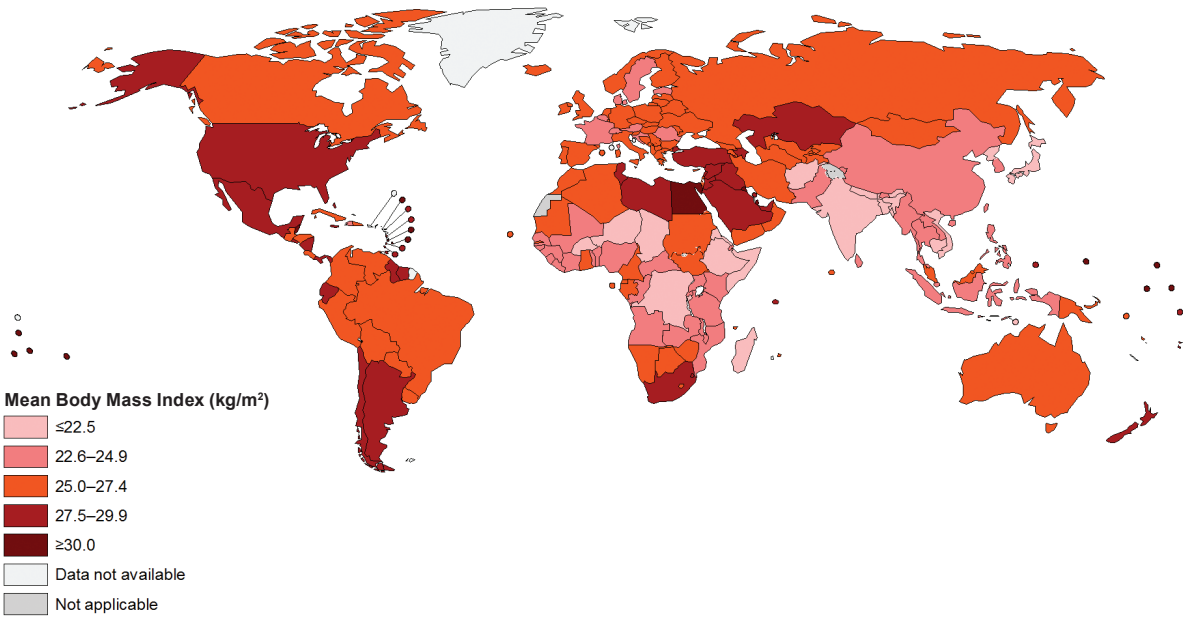


**Fig. 1.3.** Mean body mass index (kg/m$^2$), for people aged 18 years and older, in 2014 (age-standardized estimate): (a) women, (b) men. Source: WHO.

**a**



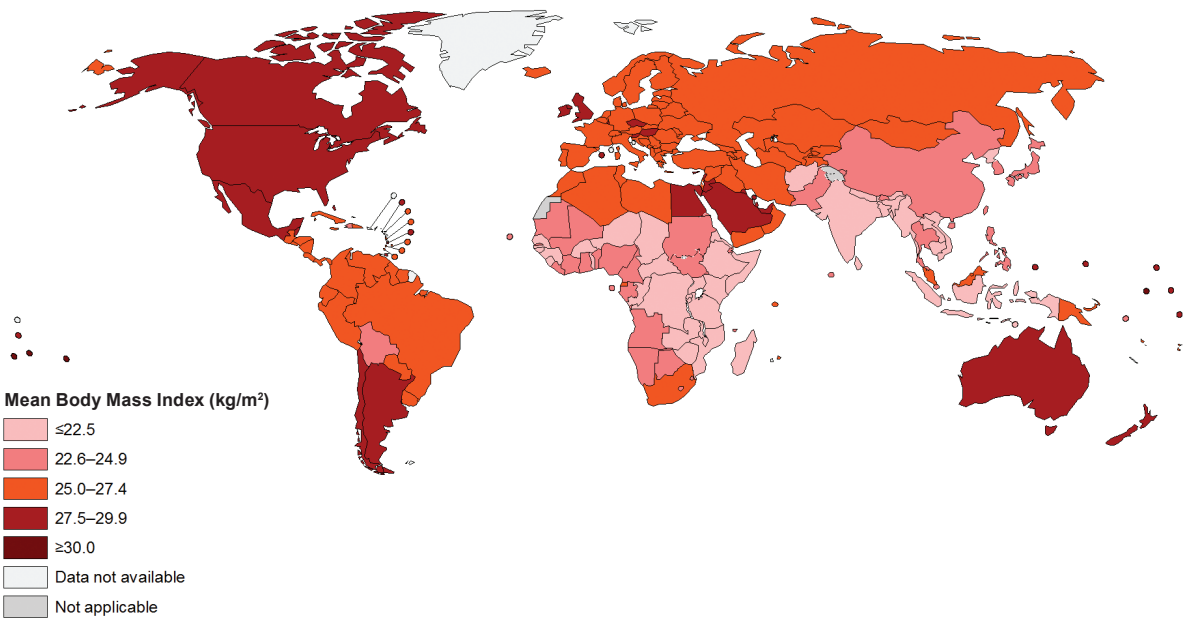

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization



**b**



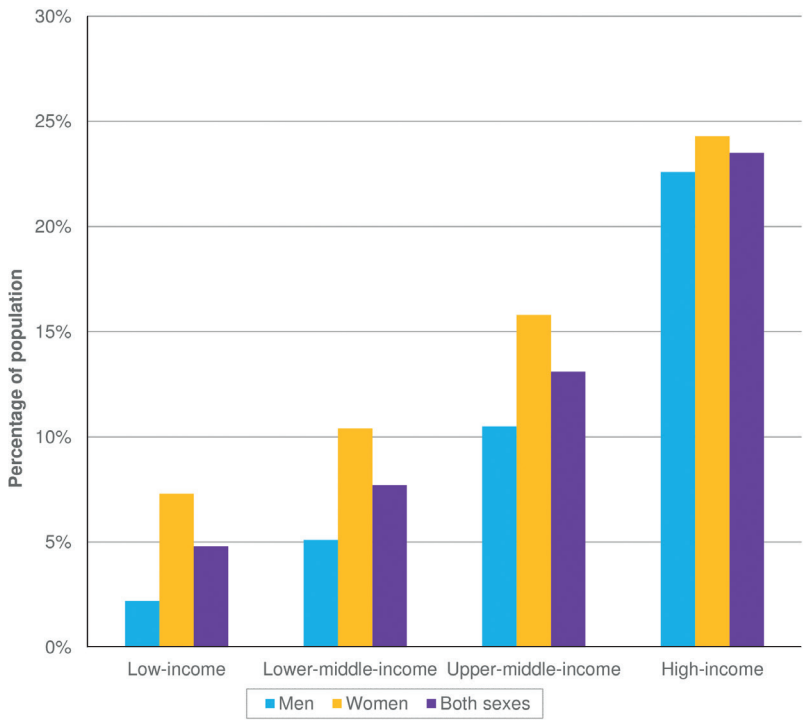

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization

© WHO 2015. All rights reserved.

**Fig. 1.4.** Prevalence of obesity by income level of countries. Source: WHO Global Health Observatory data (http://www.who.int/gho/ncd/risk_factors/overweight/en/index2.html).




## Discussion

The prevalence of obesity has been constantly increasing during the past 30 years. An increasing number of countries are affected, and low-income countries are not spared. Obesity has increasingly been considered to be a life-course condition, with its roots being established during pregnancy and with an intergenerational cycle, overlapping with the secular trend.

There is increasing evidence indicating the importance of the early-life environment in mitigating the risk of obesity later in life. Intrauterine life, infancy, and the preschool period have all been considered as critical periods during which the long-term regulation of energy balance may be programmed. Therefore, taking a life-course perspective [13] has great potential for identifying the challenges, as well as the opportunities, for taking action to address the increasing public health problem of overweight and obesity in children, with an emphasis on prevention in children younger than 5 years [14].

In childhood, in some countries, the epidemic of overweight and obesity exists alongside a continuing problem of undernutrition and micronutrient deficiencies, creating a "double burden" of nutrition-related health issues. Therefore, actions to prevent and control childhood overweight and obesity need to go hand in hand with actions to achieve the other global nutrition targets: increasing the rate of exclusive breastfeeding in the first 6 months, reducing the number of children younger than 5 years who are stunted, reducing the prevalence of anaemia in women of reproductive age, reducing the rate of childhood wasting, and reducing the rates of low birth weight.

Countries are expected to take action to incorporate the global nutrition targets and NCD targets and their indicators into their national surveillance system to be able to monitor their progress towards halting the increase in the prevalence of overweight in children and of obesity in adolescents and adults. The data gap on the overweight and obesity status of adolescents needs to be overcome quickly.

Overweight and obesity are complex and multifaceted problems. As a result, coherent and comprehensive strategies are needed to effectively and sustainably prevent and manage these conditions. Although evidence on what works as a package of interventions for obesity prevention is limited, much is known about promotion of healthy diets and physical activity, which are key to attaining the obesity-related global nutrition targets and NCD targets by 2025.

Prevention policies, which affect a country's entire population, are imperative. The European Charter on counteracting obesity [15], adopted at the WHO European Ministerial Conference on Counteracting Obesity, held in November 2006, advocated for a package of essential actions, including the protection, promotion, and support of breastfeeding; changes in the food environment (reduction of marketing pressure, particularly to children; ensuring access to and availability of healthier food, including fruits and vegetables; economic measures that facilitate healthier food choices; reduction of fat, free sugars, and salt in manufactured products; and provision of healthier foods in schools); changes in the physical environment (offers of affordable recreational/exercise facilities, including support for socially disadvantaged groups; promotion of cycling and walking by better urban design and transport policies; creation of opportunities in local environments that motivate people to engage in leisure-time physical activity; and opportunities for daily

physical activity in schools); and the promotion of healthy lifestyles (facilitating and motivating people to adopt better diets and physical activity in the workplace; developing/improving national food-based dietary guidelines and guidelines for physical activity; and individually adapted health behaviour change).

Similar regional initiatives are also being implemented in several WHO regional offices to accelerate action in counteracting the increasing problem of obesity. For example, countries of the Americas took a giant step forward in the fight against the rising epidemic of obesity when they unanimously signed on to the new 5-year Plan of Action for the Prevention of Obesity in Children and Adolescents [16], during the Fifty-third Directing Council of the Pan American Health Organization (PAHO), which was also the Sixty-sixth Session of the WHO Regional Committee for the Americas, held in September–October 2014. Among other measures, the plan calls for fiscal policies and regulation of food marketing and labelling, improvement of school nutrition and physical activity environments, and promotion of breastfeeding and healthy eating. Its goal is to halt the rise of the epidemic so that there is no increase in current country prevalence rates of obesity. To support countries in implementing the plan of action, PAHO is providing evidence-based information to inform the development of policies and regulations, regional nutrition guidelines for preschool and school feeding programmes, and guidelines for foods and beverages sold in schools. In addition, PAHO is supporting the adoption of indicators of obesity, will develop and maintain a database of nationally representative figures on overweight and obesity prevalence, and will monitor activities related to the implementation of policies, laws, and programmes in the Americas.

In October 2014, at the Sixty-fifth Session of the WHO Regional Committee for the Western Pacific, Member States supported the Action Plan to Reduce the Double Burden of Malnutrition in the Western Pacific (2015–2020) [17]. The plan addresses the rising double burden of malnutrition reflected in the unfinished agenda of reducing undernutrition and the rising burden of diet-related NCDs. It recommends actions to achieve five objectives: elevating nutrition in the national development agenda; protecting, promoting, and supporting optimal breastfeeding and complementary feeding practices; strengthening and enforcing legal frameworks that protect, promote, and support healthy diets; improving the accessibility, quality, and implementation of nutrition services across public health programmes and settings; and using financing mechanisms to reinforce healthy diets. The WHO Regional Committee for the Western Pacific is supporting countries in adopting the 2025 global nutrition targets and translating the targets into actions suitable for the country context.

# References


1. WHO (2014). Global status report on noncommunicable diseases 2014. Geneva, Switzerland: World Health Organization. Available from: http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1.

2. WHO (2014). WHA global nutrition targets 2025: childhood overweight policy brief. Geneva, Switzerland: World Health Organization. Available from: http://www.who.int/nutrition/topics/globaltargets_overweight_policybrief.pdf.

3. WHO (2000). Obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva, Switzerland: World Health Organization (WHO Technical Report Series, No. 894). Available from: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/.

4. WHO (2012). Resolution WHA65.6. Comprehensive implementation plan on maternal, infant and young child nutrition. In: Sixty-fifth World Health Assembly, Geneva, 21–26 May 2012. Resolutions and decisions, annexes. Geneva, Switzerland: World Health Organization; pp. 12–13. Available from: http://www.who.int/nutrition/topics/WHA65.6_resolution_en.pdf?ua=1.

5. WHO (2012). Global targets 2025. To improve maternal, infant and young child nutrition. Available from: http://www.who.int/nutrition/global-target-2025/en/.

6. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J (2007). Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 85(9):660–7. http://dx.doi.org/10.2471/BLT.07.043497 PMID:18026621

7. WHO Multicentre Growth Reference Study Group (2006). WHO Child Growth Standards based on length/height, weight and age. Acta Paediatr Suppl. 450:76–85. PMID:16817681

8. UNICEF, WHO, and World Bank Group (2015). Levels and trends in child malnutrition: UNICEF – WHO – World Bank Group joint child malnutrition estimates: key findings of the 2015 edition. New York, USA: United Nations Children's Fund; Geneva, Switzerland: World Health Organization; Washington (DC), USA: The World Bank. Available from: http://www.who.int/nutgrowthdb/jme_brochure2015.pdf?ua=1.

9. WHO (1995). Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee. Geneva, Switzerland: World Health Organization (WHO Technical Report Series, No. 854). Available from: http://www.who.int/childgrowth/publications/physical_status/en/.

10. WHO Expert Consultation (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 363(9403):157–63. http://dx.doi.org/10.1016/S0140-6736(03)15268-3 PMID:14726171

11. WHO (2011). Waist circumference and waist–hip ratio: report of a WHO Expert Consultation, Geneva, 8–11 December 2008. Geneva, Switzerland: World Health Organization. Available from: http://www.who.int/nutrition/publications/obesity/WHO_report_waistcircumference_and_waisthip_ratio/en/.

12. Stevens GA, Singh GM, Lu Y, Danaei G, Lin JK, Finucane MM, et al.; Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group (Body Mass Index) (2012). National, regional, and global trends in adult overweight and obesity prevalences. Popul Health Metr. 10(1):22. http://dx.doi.org/10.1186/1478-7954-10-22 PMID:23167948

13. Darnton-Hill I, Nishida C, James WP (2004). A life course approach to diet, nutrition and the prevention of chronic diseases. Public Health Nutr. 7(1A):101–21. http://dx.doi.org/10.1079/PHN2003584 PMID:14972056

14. WHO (2003). Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO Expert Consultation. Geneva, Switzerland: World Health Organization (WHO Technical Report Series, No. 916). Available from: http://www.who.int/dietphysicalactivity/publications/trs916/en/.

15. WHO Regional Office for Europe (2006). European Charter on counteracting obesity. WHO European Ministerial Conference on Counteracting Obesity, Istanbul, Turkey, 15–17 November 2006. Copenhagen, Denmark: World Health Organization Regional Office for Europe. Available from: http://www.euro.who.int/__data/assets/pdf_file/0009/87462/E89567.pdf?ua=1.

16. WHO Regional Office for the Americas (2014). Plan of action for the prevention of obesity in children and adolescents. Washington (DC), USA: World Health Organization Regional Office for the Americas. Available from: http://www.paho.org/hq/index.php?option=com_docman&task=doc_view&Itemid=270&gid=28890&lang=en&usg=AFQjCNHGJxhuPZbx-7sYGY9JB9AqaaOHQ&cad=rja.

17. WHO Regional Office for the Western Pacific (2014). Action plan to reduce the double burden of malnutrition in the Western Pacific (2015–2020). Manila, Philippines: World Health Organization Regional Office for the Western Pacific. Available from: iris.wpro.who.int/bitstream/handle/10665.1/10892/9789290617037_eng.pdf.